There's more. Chemist Dominic Wong's focus is enzymes that would cleave the branches that link hemicellulose to lignin. "This and other enzymes with similar actions would untangle the cell-wall structure and speed up its breakdown to sugars," says Wong.

In addition, Wong is engineering yeasts so that they will produce not just the usual fermentation enzymes—the ones that convert sugars into ethanol—but the cell-wall-digesting enzymes, as well.

"We'd have a more efficient bioconversion process if all the enzymes that are needed were in the yeasts," says Wong.

Equipping yeasts to do both jobs may lower costs. In the struggle to make biofuels economical, potential savings from versatile yeasts would be welcome indeed.—By **Marcia Wood,** ARS.

*This research is part of Bioenergy and Energy Alternatives, an ARS national program (#307) described on the World Wide Web at www.nps.ars.usda.gov.*

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## Genes Yield Clues to Better Bioenergy Crops

Switchgrass, an American prairie icon of biofuels, is giving up some of its deepest genetic secrets. That's happening as part of a venture to discover the structure, or sequence, of some of switchgrass's most important genetic material: marker genes.

Also known as "ESTs"—or expressed sequence tags—marker genes act as signposts. They help researchers more quickly find genes among the molecular clutter that's a normal part of any genome, especially one as huge as that of switchgrass.

ARS plant molecular biologists Christian Tobias, at the agency's Western Regional Research Center in Albany, California, and Gautam Sarath, at the Grain, Forage, and Bioenergy Research Unit in Lincoln, Nebraska, are coinvestigators on the switchgrass project. It's a collaboration with the U.S. Department of Energy's Joint Genome Institute in Walnut Creek, California. (See "Genetic Snapshots Help Brighten Switchgrass's Future," *Agricultural Research,* April 2007.)

The inquiry will speed breeding of switchgrass to make the plants better bioenergy crops. Such plants may, for example, contain more cellulose and less lignin. Lignin interferes with conversion of cellulose to ethanol.

PEGGY GREB (D1250-1)

**Molecular biologist Christian Tobias samples switchgrass plants for later extraction of DNA.**

The collaboration has already yielded the sequence of some 65,000 ESTs. All were posted to the publicly available GenBank database earlier this year.

While the switchgrass-sequencing venture nears completion, another sequencing project that will benefit biofuels research is keeping pace. It focuses on determining the sequence of all the genetic material—or genome—of a shorter, smaller grass, *Brachypodium distachyon,* or purple false brome.

As a relative of switchgrass and an even closer relative of wheat, this little plant does dual duty as a model for grassy bioenergy crops and for grains such as wheat, barley, and oats. What's more, the *Brachypodium* genome is a mere fraction of that of switchgrass or wheat. So this genome-sequencing project is expected to hasten discovery not only of genes needed to create superior biofuels crops, but also of genes crucial to designing superb grains.

Plant molecular biologist John Vogel at Albany and plant geneticist David Garvin, with the Plant Science Research Unit in St. Paul, Minnesota, are the U.S. codirectors of the project, which is also based at the Joint Genome Institute. (See *"Brachypodium*—A Little-Known Grass Gains Research Fame," *Agricultural Research,* September 2008.)

A rough draft of the *Brachypodium* genome was posted to the publicly available www.brachypodium.org website late last year, with the final sequence expected this year.—By **Marcia Wood,** ARS.